

Prevalence of Bilateral JOCD of the Knee and Associated Risk Factors

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Purpose: Juvenile osteochondritis dissecans (JOCD) of the knee affects cartilage and subchondral bone surface. Multifocal JOCD is described as multiple lesions within the knee or presence of lesions in other joints. The true prevalence of bilaterality of JOCD is unknown. The purpose of this study is to determine the prevalence of bilateral JOCD and to identify potential risk factors for bilateral disease.

Methods: We evaluated 108 consecutive patients presenting for JOCD at a single pediatric hospital system. If an OCD lesion of the knee was found, contralateral knee x-rays were performed. Lesion location was documented according to Cahill and Berg, magnetic resonance imaging (MRI) grading documented according to Dipaola, and if surgical treatment was undertaken, intraoperative grading performed according to Guhl. Patients with unilateral JOCD were compared with those with bilateral disease. Statistical analysis of categorical data was performed utilizing likelihood ratio χ^2 test or Fisher exact test and continuous data compared using nonparametric Wilcoxon 2-sample test.

Results: There were 85 male (79%) and 23 females (21%) with an average age of 12.3 years (range, 6 to 18 y). Sixty-three percent of lesions were located on the medial femoral condyle and 33% on the lateral femoral condyle. Ninety percent of all lesions were considered weight-bearing lesions. Eighty percent were considered stable on MRI evaluation. Of those lesions that underwent surgical intervention, 61% were either grade I or II lesions. Seventy-three of 108 patients (68%) underwent some form of surgical intervention. Thirty-one patients (29%) were found to have contralateral JOCD lesions. Thirty-nine percent of contralateral lesions found on contralateral radiographs were asymptomatic at presentation and nearly all of those evaluated with MRI (16 of 18) were stable. Sixty-nine percent of contralateral lesions were located on the medial femoral condyle, 27% on the lateral femoral condyle, and 94% were considered weight-bearing lesions. Twelve of 31 contralateral lesions (39%) underwent surgical intervention. Comparing patients with unilateral and bilateral disease, female patients ($P < 0.05$) and younger age at presentation ($P < 0.009$) were risk factors for

bilateral JOCD. No statistical difference among other variables was seen with regard to location, MRI or operative stability of lesion, or presence of symptoms.

Conclusions: In our consecutive series of 108 patients with JOCD, we found a 29% incidence of bilateral disease. Almost 40% of contralateral lesions were asymptomatic upon presentation. Female sex and younger age at presentation were significant risk factors for bilateral disease. Lesion location, stability, and pain were not statistically significant variables. The authors recommend bilateral radiographic knee evaluation for all patients found to have JOCD.

Level of Evidence: Level IV—retrospective case series.

Key Words: multifocal juvenile osteochondritis dissecans (MJOCD), bilateral JOCD, MRI

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Since its original description by König¹ in 1887, juvenile osteochondritis dissecans (JOCD) has been a topic of controversy and debate. The exact etiology of JOCD is unknown, but one of the more widely accepted theories is that of repetitive microtrauma.² Cumulative, low-grade traumatic events may result in subchondral stress fractures, which if not allowed the necessary time to heal may proceed to OCD lesions. This theory is consistent with recent trends toward increased athletic participation in children with year-round activity becoming more common.

The prevalence of JOCD has been reported to be anywhere from 15 to 29 per 100,000.³ Male cases predominate at a ratio of 5:3.⁴ Lesions in the posterolateral aspect of the medial femoral condyle (MFC) make up the majority of cases at >70%.^{4–6} Lesions of the inferior-central lateral condyle make up 15% to 20%. Patellar lesions are less common at 5% to 10% and trochlear lesions are rare making up <1%.^{4–6} Although isolated lesions predominate, there are also reports of multifocal lesions ranging in prevalence from 15% to 30%.^{2,6,7} Multifocal JOCD of the knee has been defined as >1 lesion in the same or contralateral knee,⁸ and the exact prevalence of multifocal disease is unknown. Multifocal JOCD (MJOCD) has been shown to be a risk factor for failure of conservative treatment and operative treatment has shown better healing rates in this subset of patients.⁸ Bilateral disease is a subset of multifocal disease that is incompletely understood. The goal of this study is to determine the prevalence of MJOCD and to identify risk factors for bilateral disease.

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METHODS

After institutional review board approval, all patients presenting at a single institution with an osteochondritis dissecans (OCD) lesion of the knee between May 2011 and September 2013 also received contralateral knee x-rays. Magnetic resonance imaging (MRI) evaluation and need for arthroscopic treatment was left to the discretion of the senior authors. Factors that contributed to MRI evaluation and surgical treatment were stability, level of pain, age, and duration of symptoms.

Lesions were defined as “stable” if they met grade I and grade II criteria as described by Dipaola et al.⁹ Grade III and grade IV lesions were defined as “unstable” (Table 1). MRI grading was carried out by a pediatric radiologist blinded to the results of arthroscopy if performed.

Anatomic location of each lesion was classified based on the Cahill and Berg classification² (Fig. 1). In the coronal plane, those lesions located in areas A and B were considered lateral femoral condyle lesions. If located in areas D and E, the lesions was considered a MFC lesion. Area C was considered a trochlear lesion. In the sagittal plane, lesions located in area A were considered non-weight-bearing, whereas those located in areas B and C were considered weight-bearing lesions. If a lesion was located in > 1 area, the area of greatest involvement was chosen.

Stable lesions were typically treated with 4 to 6 months of nonoperative care consisting of activity modifications. Multifocal lesions, clinically or MRI-graded unstable lesions, and lesions that failed conservative treatment underwent arthroscopy at the discretion of the senior authors. Each lesion was given an arthroscopic grade as described by Guhl¹⁰ (Table 2) and surgical management was based on the stability, location, age of the patient, chronicity of lesion, as well as length and severity of symptoms. Retrograde drilling, microfracture, screw fixation, loose body removal, and chondroplasty were all utilized during this study.

Exclusion criteria included incomplete radiographic evaluation.

Categorical data are compared between the groups by using likelihood ratio χ^2 test or Fisher exact test when it is appropriate. Continuous data are compared using nonparametric Wilcoxon 2-sample test. *P*-value < 0.05 is considered significant. All tests are conducted in SAS 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

A total of 108 consecutive patients with an OCD lesion of the knee were evaluated. No patients were

TABLE 1. Grading System⁹

Grade I: no break in cartilage, thickening of cartilage
Grade II: cartilage breached, low-signal rib behind fragment indicating fibrous attachment
Grade III: breached with high-signal T2 changes behind fragment suggesting fluid behind lesion
Grade IV: loose body with defect in articular surface

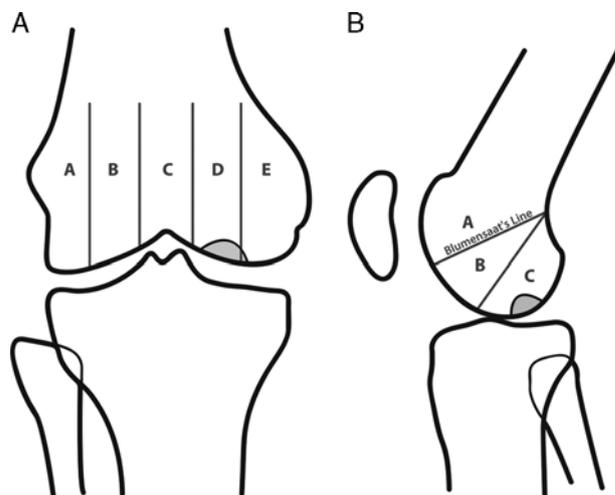


FIGURE 1. Classification of lesion location as described by Cahill and Berg.² Anterior projection (A) and lateral projection (B).

excluded. Eighty-five patients were male and 23 female. Mean patient age was 12.3 years (range, 6 to 18 y). Eighty-one percent of the patients had open distal femoral and proximal tibial physis and 19% did not. Of the 108 total patients, 31 had bilateral OCD lesions (28.7%). When examining the primary knee (knee for which the patient sought treatment), 63% were MFC, 33% LCF, 1% trochlea, and 3% patella. Ninety percent of the primary knee lesions were in a weight-bearing location. MRI was obtained on the primary knee in 85 patients. By MRI classification, 80% of these lesions were stable. Arthroscopy was completed on 90 patients, and 71% were stable by arthroscopic classification.

Radiographic evaluation of the contralateral knee found an OCD lesion in 31 patients (28.7%). Nineteen of 31 (61%) lesions were symptomatic (primarily, pain at presentation), whereas 12/31 (39%) were asymptomatic. The lesion was in the weight-bearing aspect of the knee in 29/31 (94%). The MFC was affected in 21/31 (68%) patients and the lateral femoral condyle in 9/31 (29%) patients. One patient had a contralateral medial tibial plateau OCD lesion. MRI was obtained on the contralateral knee in 18 patients. The lesion was stable in 16/18 (89%) knees. Surgical treatment was carried out on 13 patients, with 11/13 (85%) lesions classified as stable, whereas 2/13 (15%) were unstable.

To determine risk factors that would place a patient at higher risk of having bilateral knee OCD lesions, demographic and clinical factors were compared between the patients with unilateral OCD lesions and those with

TABLE 2. Arthroscopic Classification³

Grade I: softening but no breach of cartilage
Grade II: breached and stable
Grade III: definable fragment that remains partially attached (flap lesion)
Grade IV: loose body and osteochondral defect at donor site

bilateral knee OCD lesions. Univariate logistic regression analysis of the data showed female sex as a significant risk factor for having bilateral knee OCD lesions (odds ratio = 2.979; 95% CI, 0.632, 0.941; $P = 0.0107$). Age was also found to be a significant risk factor with older children less likely to have bilateral lesions (odds ratio = 0.771 per year older; 95% CI, 0.632, 0.941; $P = 0.0107$). Open physes, symptoms, location, and grade (MRI and operative) were not found to be significant risk factors.

DISCUSSION

Multifocal OCD lesions of the knee in juvenile patients have been previously described with prevalence ranging from 13% to 30%.^{2,5-7,10-19} MJOCD of the knee is defined as patients with > 1 OCD lesion in the same or contralateral knee. The exact prevalence of MJOCD, in which patients present with bilateral lesions of the knee, is unknown.⁸ To the best of our knowledge, no studies have identified risk factors to help isolate these at-risk patients.

De novo OCD lesions in adults have been described in the literature, but it is believed that most OCD lesions discovered in adulthood are due to persistence of unresolved juvenile OCD lesions.² Successful treatment of stable and unstable OCD lesions in a majority of reports have shown younger age to be an independent predictor of healing rates.^{2,4-6} The prognosis associated with a juvenile OCD lesions is better than those in adults,^{7,20-23} highlighting the importance of discovering, evaluating, and treating OCD lesions before physal closure.

Although nonoperative management has been shown to be a reliable method of treatment for young patients with stable lesions,^{2,20,24,25} there has been a trend in the literature showing multiple lesions as a factor for inadequate healing. Backes et al⁸ showed that only one quarter of patients with stable lesions healed with conservative management. With surgery, the healing rate of stable lesions was nearly twice that of unstable lesions with approximately 80% and 40% healing rates, and lesions in the MFC healed at a statistically significant greater rate than other locations. Sex, age, and discoid menisci were shown to have no effect on healing in their study.

A limitation to this study is discerning the difference between a true OCD lesion and a possible "ossification variant." This becomes particularly difficult when the contralateral knee is asymptomatic. Gebarski and Hernandez¹⁹ identified features that are helpful to distinguish normal variants from an OCD lesion. These features include location in the inferocentral posterior femoral condyles with intact cartilage, accessory ossification centers, spiculations, residual cartilaginous model, and lack of bone marrow edema. Although these factors were considered during evaluation of each lesion, it is possible that an "ossification variant" was classified as an OCD lesion and vice versa. Another limitation is that not all patients in this study were skeletally immature. Twenty-one patients (19%) had closed physes upon presentation. By including these patients, we were able to increase the

power of the study and it was believed that the OCD lesions of these very young adults were likely present before physal closure.

CONCLUSIONS

Our study population demonstrated a 29% prevalence of bilateral OCD lesions of the knee, with approximately 40% of those lesions being asymptomatic. Female sex and younger age at presentation were significant risk factors for bilateral disease. Lesion location, stability, and pain were not statistically significant variables. Because of the potential morbidity of OCD lesions of the knee, improved prognosis with early treatment, and decreased healing rates with nonoperative treatment of MJOCD lesions, we recommend bilateral radiographs of the knee when evaluating a juvenile patient with an OCD lesion of the knee with particular attention to females and younger children.

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